

13 DECEMBER 2002



*Flying Operations*

**AIR FORCE AIRCRAFT DEMONSTRATIONS**  
**(F-22, CV-22)**

**COMPLIANCE WITH THIS PUBLICATION IS MANDATORY**

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Certified by: AFMC/CC (General Lester L. Lyles)

Pages: 33

Distribution:

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This instruction implements guidance in AFD 11-2, *Flight Rules and Procedures*; and AFI 11-209, *Air Force Participation in Aerial Events*. It provides guidance and procedures for Air Force performance of specific model, design, series (MDS) single-ship aircraft demonstrations and mission capabilities demonstrations. It designates Air Force Materiel Command as lead command for the F-22, and CV-22 aircraft demonstrations. MAJCOMs, field operating agencies (FOAs), and direct reporting units (DRUs) may supplement this instruction. MAJCOMs, FOAs, and DRUs will coordinate their supplements with HQ Air Force Materiel Command, Director of Operations, Current Operations Division (AFMC/DOO) prior to publication and forward one copy to HQ USAF/XOOO after publication. See **Attachment 1** for a glossary of references and supporting information. Ensure that all records created by this AFI are maintained and disposed of IAW AFMAN 37-139, "Records Disposition Schedule."

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## Chapter 1

### OPERATIONAL PROCEDURES

**1.1. Introduction.** USAF uses single-ship aerial demonstration teams to exhibit the capabilities of modern high performance USAF aircraft and the degree of skill required to operate these aircraft. AFMC is designated lead command and will establish standard criteria for single-ship aerial demonstrations of the F-22 and CV-22 aircraft. This instruction provides specific maneuvers, sequences, and parameters governing the execution of these demonstrations. Other MAJCOMs flying single-ship aerial demonstrations of these MDS aircraft will comply with this instruction. Policy and procedures for team management, selection, training, and scheduling will be in accordance with (IAW) applicable MAJCOM supplements. The directives listed in [Attachment 1](#) provide further policy or procedural guidance in the conduct of these events.

**1.2. Terms Explained.** Unless otherwise indicated, terms and definitions used in AFI 11-209, *Air Force Participation in Aerial Events*; AFI 35-101, *Public Affairs Policies and Procedures*; and this instruction are the same.

**1.3. Waiver Authority:** HQ USAF/XOOO has delegated waiver authority for this instruction to HQ AFMC/DO. Other MAJCOMs must submit waiver requests through appropriate MAJCOM channels to AFMC/DOO, 4375 Chidlaw Road, Room S143, WPAFB OH 45433.

#### **1.4. Responsibilities:**

##### **1.4.1. MAJCOM/CC:**

1.4.1.1. Provides policy for the MAJCOM's single-ship demonstrations IAW this publication.

1.4.1.2. Certifies first year single-ship demonstration pilots prior to of their first aerial demonstration.

##### **1.4.2. MAJCOM/DO:**

1.4.2.1. Provides supervisory direction over the single-ship demonstrations.

1.4.2.2. Approves syllabi for single-ship demonstration aircrew upgrade.

##### **1.4.3. MAJCOM Aerial Events or MAJCOM designee:**

1.4.3.1. Performs annual review of the MAJCOM supplement to this AFI and unit single-ship demonstration training syllabi.

1.4.3.2. Prepares waiver recommendations for HQ AFMC/DO approval.

1.4.3.3. Coordinates initial MAJCOM/CC certification of first year single-ship demonstration pilots IAW [Attachment 7](#).

1.4.3.4. Maintains demonstration team certification documentation.

1.4.3.5. Coordinate requests for aerial demonstrations with operations group.

**1.4.4. NAF commanders or equivalent** will approve single-ship demonstration pilots prior to MAJCOM/CC's certification for first-year demonstration pilots.

**1.4.5. Wing commanders or equivalent:**

- 1.4.5.1. Select and train demonstration team personnel IAW this instruction.
- 1.4.5.2. Forward the upgrading demonstration pilot's grade book per MAJCOM supplement for approval.
- 1.4.5.3. Annotate pre-certification in demonstration pilot grade book and forward to NAF/CC or equivalent for endorsement.
- 1.4.5.4. Annotate re-certification in demonstration pilot grade book for second and subsequent year demonstration pilots.
- 1.4.5.5. Select and certify narrators and rated ground safety observers.
- 1.4.5.6. Complete and submit an Annual Team Assessment to MAJCOM/CC 30 days prior to first air show, IAW [Attachment 3](#).
- 1.4.5.7. Provide a ground video and HUD (Heads-Up-Display) tape of a current performance for WG/CC re-certified pilots to MAJCOM/DO.

**1.4.6. Operations group commanders or equivalent**

- 1.4.6.1. Provide command oversight of the demonstration team.
- 1.4.6.2. Coordinate aerial demonstration requests with MAJCOM Aerial Events POC.
- 1.4.6.3. Ensure the ground video or HUD tape of every practice and demonstration is reviewed by WG/CC, WG/CV, OG/CC or SQ/CC that is qualified in MDS. E-mail the completed grade sheet to MAJCOM/DO, info MAJCOM Aerial Events, within 5 duty days of each home training event/ demonstration or within 5 duty days after returning to home station after deployed demonstrations.

**1.4.7. Demonstration pilots:**

- 1.4.7.1. Coordinate demonstration team support requirements with event point of contact.
- 1.4.7.2. Coordinate with local Air Force recruiter team's availability and ability to support local Air Force recruiting efforts.
- 1.4.7.3. Cancel any demonstration when the assigned performance location compromises safety or exceeds aircraft performance capabilities.
- 1.4.7.4. For off-station sites, Accomplish either a practice demonstration or aerial survey (IAW [Attachment 5](#)) at the air show site prior to air show demonstration.
- 1.4.7.5. Review and grade the HUD tape of every practice and demonstration and forward to reviewing officer (see [1.4.6.2.](#)).
- 1.4.7.6. **Individual Responsibility.** Each officer assigned to the MAJCOM Single-Ship Demonstration Team must fully understand the solemn trust and special obligation that accompanies a position on the demonstration team. Individual behavior, bearing and appearance shape not only the team image but also public image of the USAF. First among the team's many responsibilities is the safety of demonstration audiences. There can be no aspect of any team member's life style or daily conduct that would in any way impair the team's performance or jeopardizes public safety. Each member must be at the peak of physical and mental capabilities for all demonstration team activities. In addition, given the continuous rigor of the demonstration team schedule, each

member must be able to sustain this mental and physical capability level over an extended period of time. The key to this sustained performance is the establishment of a personal daily regimen to include regular eating, hydration, adequate sleeping, and proper exercise habits, which will minimize the adverse effects of continuous travel, cultural/dietary differences, and time zone changes.

1.4.7.6.1. In view of the special obligations incumbent whether performing in the air or providing ground support, each member of the team, will adhere to the following policies:

In no case will the provisions of AFI 11-401, *Flight Management*, concerning the consumption of alcoholic beverages be violated.

Additionally, alcoholic beverages will not be consumed later than 12 hours prior to reporting for duty when aerobatic maneuvers are scheduled for the following day.

For cross-country flights not involving aerobatic maneuvers, the provisions of AFI 11-401 apply.

Although the provisions of this policy do not quantify the maximum amount of alcohol permitted to be consumed, the intent, in concert with a daily regimen and peak daily mental and physical capability, mandates the highest individual responsibility and moderation with the fullest recognition of the next day's duties and obligations.

1.4.7.6.2. Lifestyle and daily activities, on and off duty, will be governed by the need to minimize personal risk and totally avoid any display of reckless behavior. Activities that could result in personal injury or jeopardize availability for team activities are inappropriate for team members. Although each demonstration team activity deserves special attention, those involving demanding flight operations unique to the air demonstration mission, specifically aerobatic maneuvers, whether for practice or official demonstration, are the most critical.

#### **1.4.8. Demonstration team ground safety observers:**

1.4.8.1. Complete safety observer training and documentation per this instruction.

1.4.8.2. Monitor all practices and demonstrations with maneuvers conducted below 2,000 feet AGL.

1.4.8.3. Maintain two-way radio communication with the demonstration pilot, monitor demonstration pilot altitude and airspeed radio calls, and direct maneuver abort if outside prescribed parameters.

1.4.8.4. Monitor the demonstration for potential hazards (e.g., flocks of birds, unscheduled aircraft, weather).

1.4.8.5. Critique each maneuver and note needed improvements in the performance. However, in no case should critiquing maneuvers take precedence over monitoring the safe accomplishment of maneuvers.

### **1.5. Requests and Approval:**

1.5.1. Civilian locations requesting an aerial demonstration must submit the appropriate request to the Office of the Secretary of Air Force for Public Affairs (SAF/PA). SAF/PA notifies applicable MAJCOM of events that are eligible for consideration.

1.5.2. Air Force units may submit a request directly to HQ AFMC/DOO or MAJCOM designee for consideration.

1.5.3. Requests from other services should be submitted, through command channels, to HQ AFMC/DOO or other appropriate MAJCOM office in accordance with applicable directives.

**1.6. F-22 Arresting Gear Support.** Show sites without arresting gear, with runways less than 8,000 feet must have a suitable airfield with arresting gear within diversion fuel planning.

### **1.7. Reporting:**

1.7.1. The pilot, narrator, ground safety observer or NCOIC will transmit via phone, fax, or e-mail a post-demonstration report to the MAJCOM Aerial Events office after each day's scheduled demonstration. RCS: HAF-XOO(AR)0212, continue reporting during emergency conditions, delayed precedence. Submit data requirements as prescribe, but may be delayed to allow the submission of higher precedence reports. As a minimum, include:

Weather (if a factor)

Show profile

Estimated crowd count

Unusual occurrences/remarks

Any report with an unusual occurrence requires an immediate detailed e-mail/fax.

### **1.8. Recommended Changes:**

1.8.1. The demonstration flight sequence and maneuvers will not be altered, except as described in appropriate profile chapter. Any proposed changes must be forwarded through appropriate MAJCOM channels and approved in advance by AFMC/CC

1.8.2. Recommendations for changes to this instruction should be submitted through MAJCOM channels to HQ AFMC/DOO.

1.8.3. Demonstration teams may supplement this instruction as necessary. Team organization, maintenance support, selection criteria, and training programs for new pilots are examples of items that may be supplemented. Submit supplements to HQ AFMC/DOO for coordination prior to publication and forward one copy to HQ USAF/XOOO after publication.

### **1.9. Demonstration Performance Reviews/Grade Sheets:**

1.9.1. Every demonstration flight involving aerobatics of any kind conducted below 2,000 feet AGL will be videotaped. Each demonstration will be debriefed using these videotapes. MAJCOM/CC or DO may request a videotape and HUD tape for review at any time during the air show season. Demonstration teams will maintain videotapes and HUD tapes for a minimum of one year.

1.9.2. The pilot and ground safety observer will evaluate each practice and demonstration using the HUD tape and grade sheet provided in [Attachment 4](#). The goal is a direct and meaningful evaluation of each maneuver which can serve as a debriefing tool, identify any adverse trends, and as a cumulative record of how each maneuver was flown, depending on pilot skills, relative pilot air show proficiency (experience), and weather conditions. The goal is not to provide perfect scores to make the

pilots feel good, nor should a grade of 1 or 0 be automatically considered marginal/unsatisfactory unless the manner in which the maneuver was performed was dangerous or created a safety of flight situation.

1.9.3. Each maneuver will be graded using a scale of 0 to 4 and averaged to compute an overall demonstration grade of 0 to 4. Wing reviewers must comment and make recommendations on any maneuver graded zero (0). A maneuver grade of 0 should not be automatically considered dangerous unless the manner in which the maneuver was performed created a safety of flight situation. However, if safety is compromised then the overall demonstration grade will be zero (0). Wing reviewers will recommend additional training for any overall demonstration graded zero (0). The average grade for a typical air show should be a two (2). The grade sheets will reflect altitude and airspeed to the greatest accuracy possible. The following grading criteria will be used to establish individual maneuver and overall demonstration grades.

1.9.3.1. To compute the maneuver grade, "X" equals the distance between the target and minimum altitudes. As an example, if the target altitude is 6,000 feet and the minimum altitude is 5,000 feet then "X" equals 1000 feet and  $1/2X$  equals 500 feet. Grade 0 would be given for all altitudes below 5,000 feet; Grade 1 for all altitudes from 5,000 to 5,499 feet; Grade 2 for all altitudes 5,500 to 5,999 feet and above 6,501 feet; Grade 3 for all altitudes from 6,001 to 6,500 feet; and Grade 4 if altitude equals 6,000 feet.

1.9.3.2. GRADE 0 -- Altitude below minimum, or airspeed out of limits

1.9.3.3. GRADE 1 -- Altitude  $>1/2X$  below target, and airspeed within limits

1.9.3.4. GRADE 2 -- Altitude  $\leq 1/2X$  below target or  $>1/2X$  above target, and airspeed within limits

1.9.3.5. GRADE 3 -- Altitude  $\leq 1/2X$  above target, and airspeed  $\pm 25$  knots of target

1.9.3.6. GRADE 4 -- Altitude on target, and airspeed  $\pm 10$  knots of target

1.9.3.7. OVERALL GRADE = Computed average of the maneuver scores.

- 0 = Dangerous performance
- 1 = Safe performance, but trend is low
- 2 = Average performance
- 3 = Outstanding performance
- 4 = Perfect performance; no deviations

**1.10. Currency:** The following table will be used to determine currency requirements. Demonstration flights will be tracked by AFORMS.



Demo Qual Level	Training Event Needed
Currency	1 practice every 30 days
To regain Currency:	1 practice at 1000' minimum
Last Practice 31-45 days	1 practice at 500' minimum
Last practice >45 days	2 practices at 2000' minimum 1 practice at 1000' minimum 1 practice at 500' minimum

### 1.11. Termination Procedures:

- 1.11.1. Demonstrations involving aerobatics flown below 2,000 feet AGL will be terminated when:
- 1.11.2. The safety observer is unable to monitor the safe performance of maneuvers.
- 1.11.3. Two-way radio communication is lost between the demonstration pilot and safety observer.
- 1.11.4. Videotaping is lost.
- 1.11.5. Any time when in the judgment of the pilot or safety observer the safety of the pilot or spectators is compromised.

**1.12. Altimeter Procedures.** It is essential that each demonstration pilot be able to quickly and accurately assess actual altitude above the ground during any maneuver in the demonstration. To avoid the mental exercise required to subtract an odd-numbered field elevation from the MSL altimeter reading to get above ground altitude, one of the two procedures described below will be used to "zero the altimeters" (QFE). These procedures will be used for all practice and actual demonstrations whether flown from takeoff at the show site or takeoff from a deployed location.

1.12.1. **Zero Altimeter Method.** Dial aircraft altimeter until indicator reads "0."

1.12.2. **Nearest 1,000 Feet Method.** The Ground Safety Officer is responsible for obtaining the current altimeter setting for the field elevation and the altimeter setting to zero the altimeter to the nearest 1,000 feet setting. Dial the altimeter to the most appropriate 1,000 feet corrected field elevation (500 round down, 501 round up).

**1.13. Use of Teams for Static Display.** The demonstration pilot and narrator/ground safety observer should normally arrive in two aircraft with one to be used as a spare for the demonstration. MAJCOMs may determine if second aircraft can be used as static if spare is not required.

## Chapter 2

### DEMONSTRATION TEAM PERSONNEL SELECTION AND TRAINING

**2.1. General.** A standard team includes two aircraft, one demonstration pilot, a minimum of two narrators, and necessary support personnel. Team will deploy with a ground safety observer. Ground safety observers will not simultaneously perform narration duties.

**2.2. Demonstration Pilot Selection.** Demonstration pilots will be selected by Wing Commanders and certified by MAJCOM/CC.

**2.3. Narrator/Ground Safety Observer Selection.**

2.3.1. Narrator. Assigned NCOs may perform narration duties.

2.3.2. Ground safety observer. Pilots selected as ground safety observers must be current and qualified in MDS.

**2.4. Training.** Final Wing Commander review, pre/re-certification of the demonstration pilot, will be documented by the Wing Commander and forwarded to MAJCOM/CC. Training will be accomplished according to the guidelines of this instruction.

2.4.1. The Wing Commander may alter the training sequence and individual sorties, as necessary, to ensure proficiency and progress. Additional training sorties (TS) may be added as required.

2.4.2. Maneuvers will be performed as described in this AFI.

2.4.3. New demonstration pilots will receive flight training from a currently qualified demonstration pilot. Each new demonstration pilot will receive extensive ground training from his or her predecessor or a currently qualified demonstration pilot.

2.4.4. All training will be accomplished in VMC. Each practice will be over a runway environment

2.4.5. Training performance will be documented in an official grade book and progress monitored by the Wing Commander.

2.4.6. Wing Commanders review, pre/re-certify ground safety observers and narrators.

2.4.7. Demonstration team film crews will be thoroughly trained. Training should emphasize equipment operation, sound techniques to capture demonstration narration, and techniques to capture the ground environment in the field of view during low altitude maneuvers.

2.4.8. Demonstration pilots will receive training on common conditions leading to aborts for each maneuver.

2.4.9. Demonstration pilots and ground safety observers will receive academic and flight training for abort procedures.

**2.5. Training Syllabus.**

2.5.1. GT-1 (Ground Training):

Standard Procedures

Fuel Requirements

Waivers

Aircraft Handling Characteristics

Safety Considerations

Lessons Learned

Emergency/Abort Procedures

2.5.2. GS-1 (Ground Simulator Training)

Crosschecking parameters during Maneuver Description

Abort procedures

Abort mechanics

Slow-speed maneuvering

Recognition and prevention of out-of-control situations

Emergency procedures

2.5.3. TS-1 Full profile, minimum altitude 2,000' AGL

2.5.4. TS-2 Full profile, minimum altitude 1,000' AGL

2.5.5. TS-3 Full profile, minimum altitude 1,000' AGL

2.5.6. TS-4 Full profile, minimum altitude 500' AGL

2.5.7. TS-5 Full profile, minimum altitude 500' AGL

**NOTE:** Supersonic Pass procedures can be practiced at less than 1.0 Mach for noise considerations.

## Chapter 3

### F-22 DEMONSTRATION MANEUVERS

#### *Section 3A—General Guidelines*

**3.1. General.** Maneuvers discussed in this chapter will be used for training and for F-22 aerial demonstrations. The demonstration sequence is designed so each maneuver is normally flown in the same direction with respect to the crowd line with the following exceptions, Sonic Boom Pass, F-22/F-15 or F-16 Weapons Bay Comparison Pass, and the Slow Speed Pass/Powerhouse Climb Pass. As a result, the show is always oriented the same way from the spectators' point of view. Each maneuver is discussed in detail beginning at paragraph 3.10. Abnormal procedures are written for each maneuver. If the entry conditions are not met for any maneuver, a wings level pass should be flown and the pilot should go to the next maneuver. Ground safety observer will monitor demonstration pilot altitude and airspeed radio calls and direct an abort when parameter limits are exceeded.

**3.2. Chase Aircraft.** A safety chase aircraft is optional and will maintain area chase with the exception of the F-22/F-15 or F-16 Weapons Bay Comparison Pass. If available, an additional F-15, in combat configuration, should be flown in the Weapons Bay Comparison Pass, to the F-22.

**3.3. Aircraft Configuration and Fuel Requirements.** Aircraft configuration for all demonstrations will be clean. Fuel considerations include: divert requirements, cable availability, temperature, and density altitude. Normal minimum fuel for take-off is:

3.3.1. Edwards AFB Show: 16,500 pounds.

3.3.2. Shows without Sonic Boom: 13,000 pounds

**3.4. Airspeed and G-Limits.** Demonstration pilots will not exceed 0.95 Mach, (Exceptions; Sonic Boom Pass is 1.4 Mach). The maximum target G for this demonstration is 3 Gs. This does not preclude a momentary increase in G for safety considerations.

**3.5. Show-line Restrictions.** The majority of the F-22 demonstration will be flown on the 1500 foot-show line in reference to the distance from the crowd. Non-aerobatic maneuvers (less than 90 degrees of bank) may be flown on the 500 foot show line.

**3.6. Airspace Requirements.** Desired airspace for the F-22 is:

3.6.1. Edwards Show: 30,000 feet AGL and normally a 20-mile radius from show center horizontally.

3.6.2. Non-Edwards Show: The minimum dimensions of the aerobatic box are 4,000 feet wide, 8,000 feet long, and 15,000 feet AGL.

**3.7. Runway Requirements.** The runway, taxiway, and parking area must be stressed for a 65,000-pound aircraft with single wheel type landing gear. Minimum runway length is 8,000 feet x 75 feet, cable availability required.

**3.8. Weather Requirements.** Weather requirements for the high profile are a ceiling of at least 7,000 feet, three miles ground and five miles in-flight visibility with a discernible horizon. Ceiling required for the low profile is 2,500 feet. Maneuvers will be planned to maintain VMC throughout the show sequence.

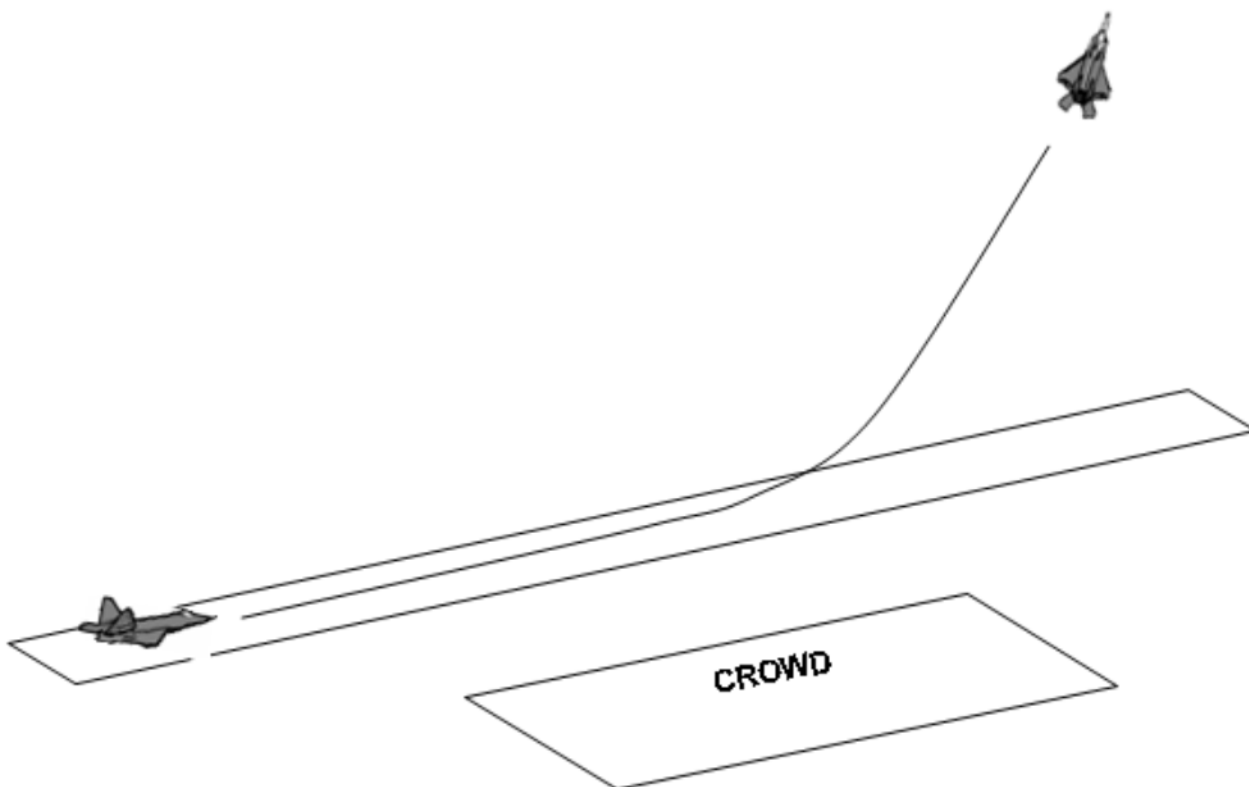
**3.9. High Density Altitude Demonstrations .** For high density altitude shows, adjust AIRSPEED PARAMETER LIMITS in accordance with the following:

For each 2,000 feet of altitude above 3,000 feet MSL add 10 knots to airspeeds.

*Section 3B—Profile*

**3.10. Max Effort Takeoff and Climb.**

**Figure 3.1. F-22 Max Effort Takeoff and Climb.**



**F-22 Max Effort Takeoff and Climb**

**Table 3.1. F-22 Max Effort Takeoff and Climb Parameters.**

TARGET PARAMETERS			
Altitude AGL	Airspeed KCAS	Power Setting	G
Entry 30'	200	MAX	2-3
Exit 15,000'	450	MAX	N/A

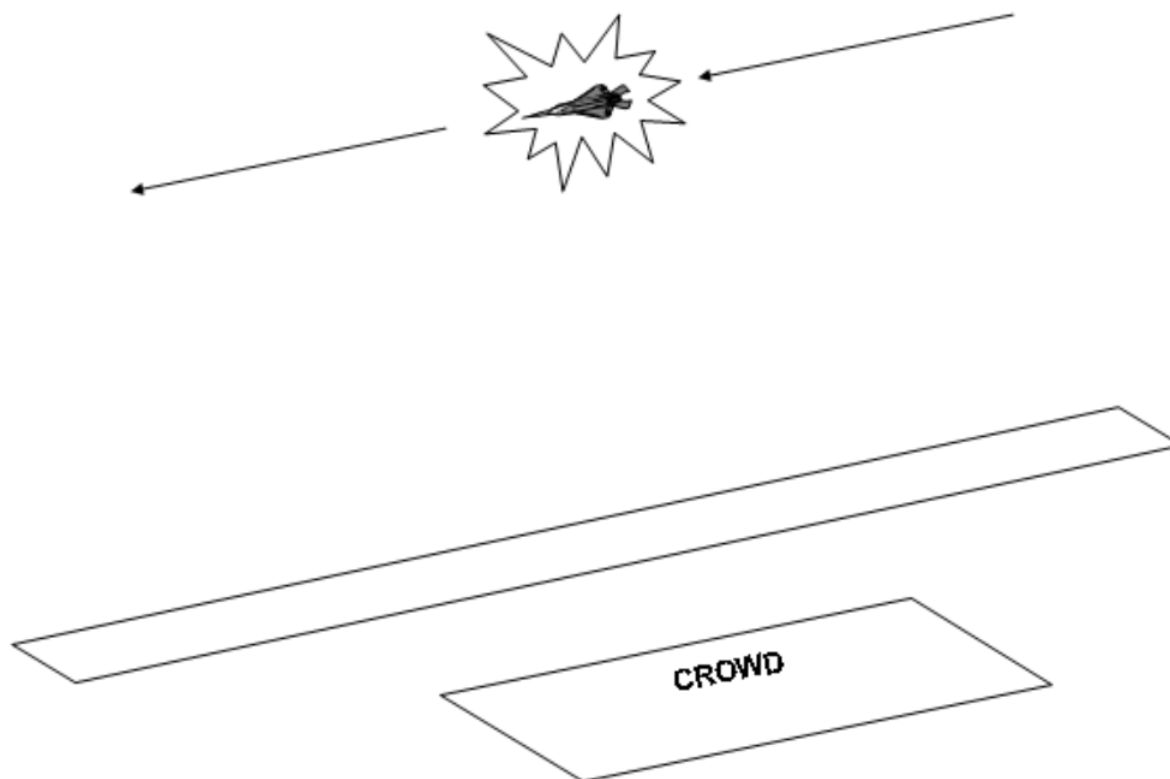
PARAMETER LIMITS				
Altitude AGL	Airspeed KCAS MIN/MAX		Power Setting	G
Entry 20'	150	.95M	MAX	2-3
Exit 15,000'	150 KCAS	N/A	N/A	N/A

3.10.1. **Maneuver Description.** Accomplish a normal takeoff. The rotation airspeed is 125 knots and should be accomplished using a smooth, continuous pull to obtain the normal takeoff attitude. Raise the gear with a positive rate of climb once the gear is up. After gear and flap retraction, level off at 30 feet and accelerate to a minimum of 150 KCAS. At show center with a minimum of 150 knots, pull up 75 to 90 degrees nose high using 2 to 3 Gs to 15,000 feet AGL. At Edwards AFB continue climb to 30,000' AGL to set up for Supersonic Pass. For shows outside of Edwards AFB descend to set up for Level Pass.

3.10.2. **Abnormal Procedures .** Use caution when taking off from short runways, runways at high-pressure altitudes, or wet runways. TOLD data is critical and must be computed very carefully at each show site. During the climb out, if the angle-of-attack goes above 26 degrees angle-of-attack unload and accelerate to decrease angle-of-attack below 26 degrees. A climb to 15,000' AGL can then be continued.

### 3.11. F-22 Supersonic Pass. (Edwards AFB Only)

Figure 3.2. F-22 Supersonic Pass (Right to Left).



### F-22 Supersonic Pass

(Edwards AFB Only)

Table 3.2. F-22 Supersonic Pass Parameters.

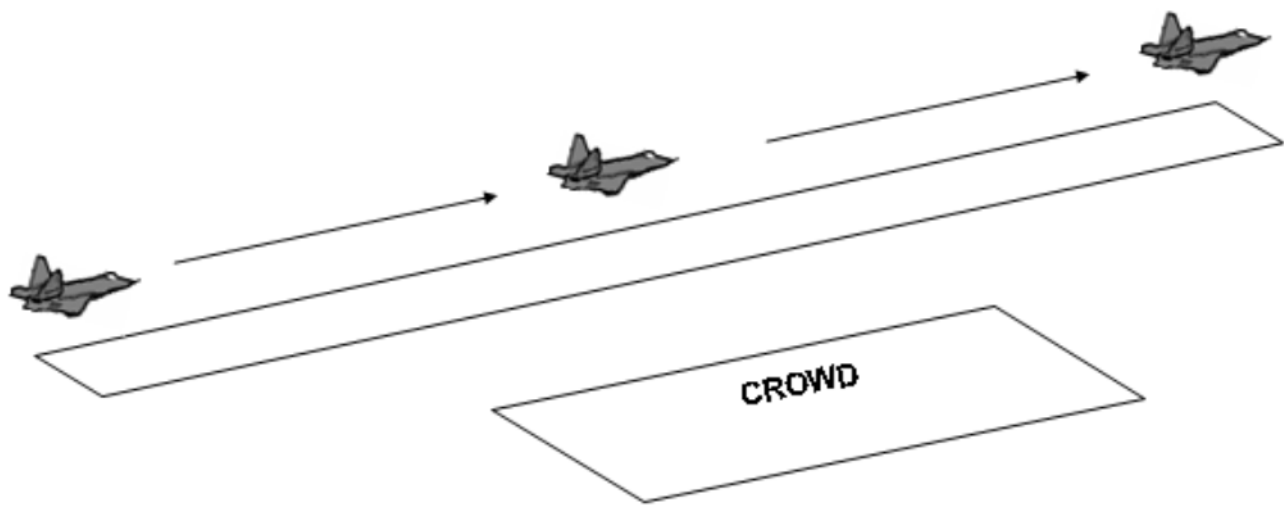
TARGET PARAMETERS				
Altitude AGL		Airspeed KCAS	Power Setting	G
Entry	30,000'	.95M	AB	1
Exit	30,000'	1.4M	IDLE to MIL	1

PARAMETER LIMITS				
Altitude AGL	Airspeed KCAS MIN/MAX		Power Setting	G
Entry <b>max</b> 30,000'	N/A	.99M	A/R	N/A
Exit <b>max</b> 30,000'	N/A	1.4M	A/R	N/A

- 3.11.1. **Maneuver Description: FLOWN AT EDWARDS AFB ONLY!** At 30,000 feet AGL in a wings-level attitude, accelerate in AB and fly down the show line in MIL power at 1.4 Mach. At completion of pass decelerate and descend to setup for Level Pass.
- 3.11.2. **Abnormal Procedures: None**

3.12. F-22 Level Pass.

Figure 3.3. F-22 Level Pass (Left to Right).



F-22 Level Pass

Table 3.3. F-22 Level Pass Parameters.

TARGET PARAMETERS			
Altitude AGL	Airspeed KCAS	Nominal Power Setting	G
Entry 500'	450	A/R	N/A
Exit 500'	450	A/R	N/A

PARAMETER LIMITS				
Altitude AGL	Airspeed KCAS MIN/MAX		Power Setting	G
Entry <b>min</b> 450'	425	475	MIL	N/A
Exit <b>min</b> 450'	425	475	MIL	N/A

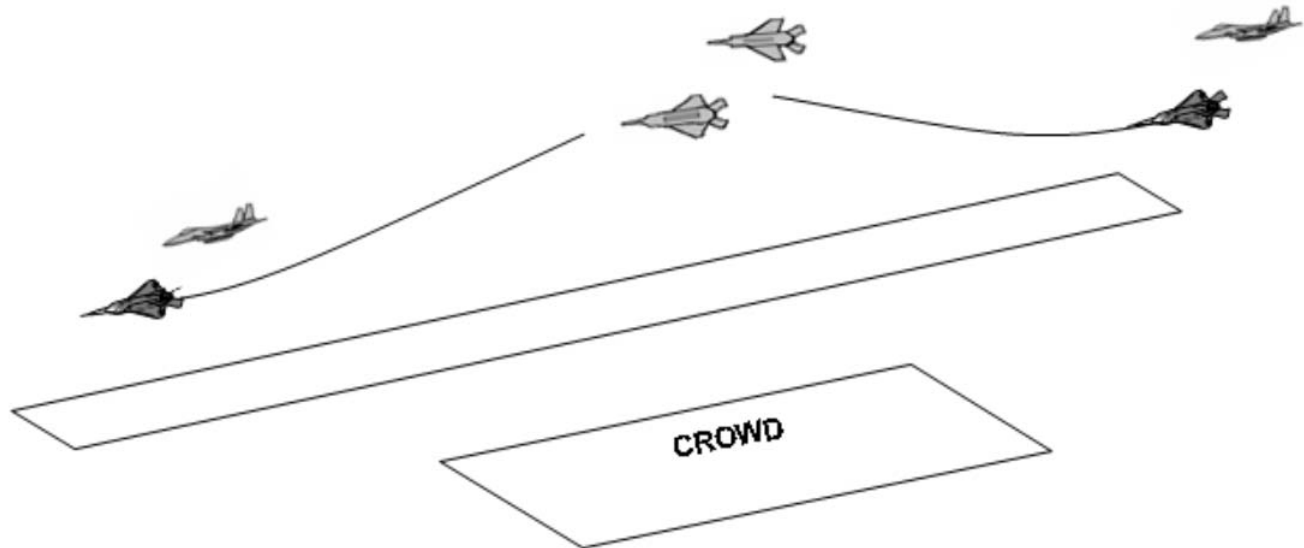
3.12.1. **Maneuver Description:** After completion of takeoff or supersonic pass descend to 500' AGL and maintain 450 KCAS and perform a level pass over show center. After completion perform a repositioning maneuver and rejoin with chase aircraft for Weapons Bay Comparison Pass.



3.12.2. Abnormal Procedures: None.

### 3.13. F-22/F-15 or F-16 Weapons Bay Comparison Pass (Optional).

Figure 3.4. F-22/F-15 or F-16 Weapons Bay Comparison Pass (Right to Left)



### F-22/F-15 or F-16 Weapons Bay Comparison Pass

Table 3.4. F-22/F-15 or F-16 Weapons Bay Comparison Pass Parameters (Optional).

TARGET PARAMETERS			
Altitude AGL	Airspeed KCAS	Power Setting	G
Entry 500'	300	Thrust for Level Flight ( <i>or</i> A/R)	1
Exit 500'	300	Thrust for Level Flight ( <i>or</i> A/R)	1

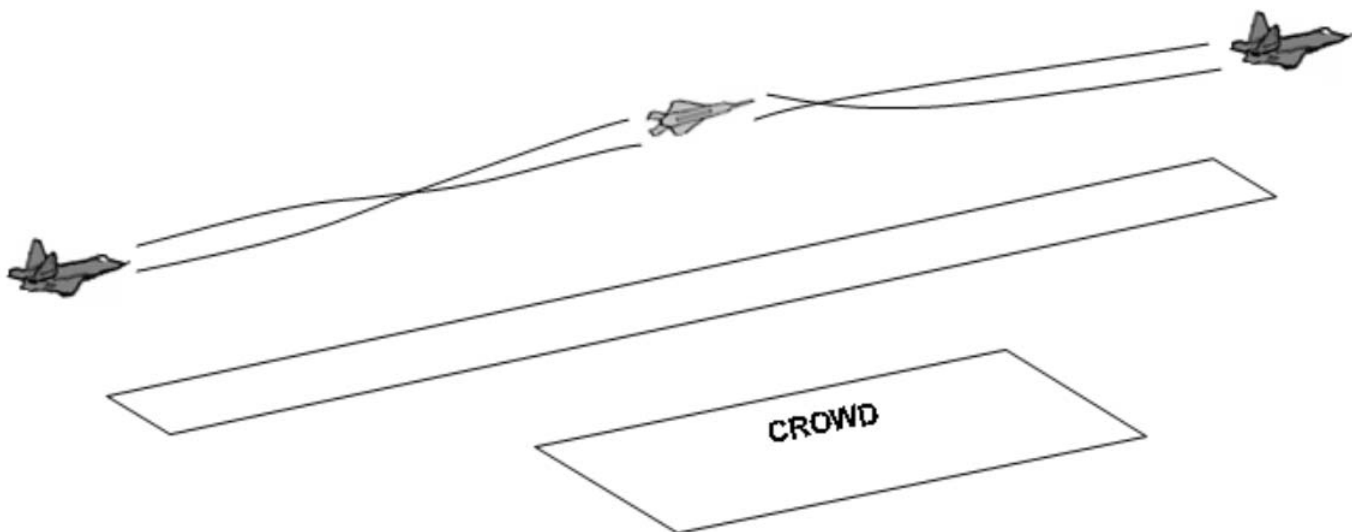
PARAMETER LIMITS				
Altitude AGL	Airspeed KCAS MIN/MAX		Power Setting	G
Entry <b>min</b> 450'	275	325	Thrust for Level Flight ( <i>or A/R</i> )	0-3
Exit <b>min</b> 450'	275	325	Thrust for Level Flight ( <i>or A/R</i> )	0-3

3.13.1. **Maneuver Description:** F-15 will fly finger tip formation with F-22. F-22 will open weapon bay doors during repositioning maneuver. Aircraft will fly down show line at 300 KCAS. When aircraft cross the threshold pull nose up 10-15 degrees nose high and roll 20 degrees for a show center belly shot. Prior to reaching end of runway recover to wings level and perform a repositioning maneuver to set up for the Single Aileron Roll. Close bay doors.

3.13.2. **Abnormal Procedures:** If the doors fail to close, recycle doors. If the doors remain open, land as soon as practical.

#### 3.14. F-22 Single Aileron Roll.

Figure 3.5. F-22 Single Aileron Roll (Left to Right).



**F-22 Single Aileron Roll**

**Table 3.5. F-22 Single Aileron Roll Parameters.**

TARGET PARAMETERS			
Altitude AGL	Airspeed KCAS	Power Setting	G
Entry 500'	350	Thrust for Level Flight ( <i>or A/R</i> )	1
Exit 500'	350	Thrust for Level Flight ( <i>or A/R</i> )	1

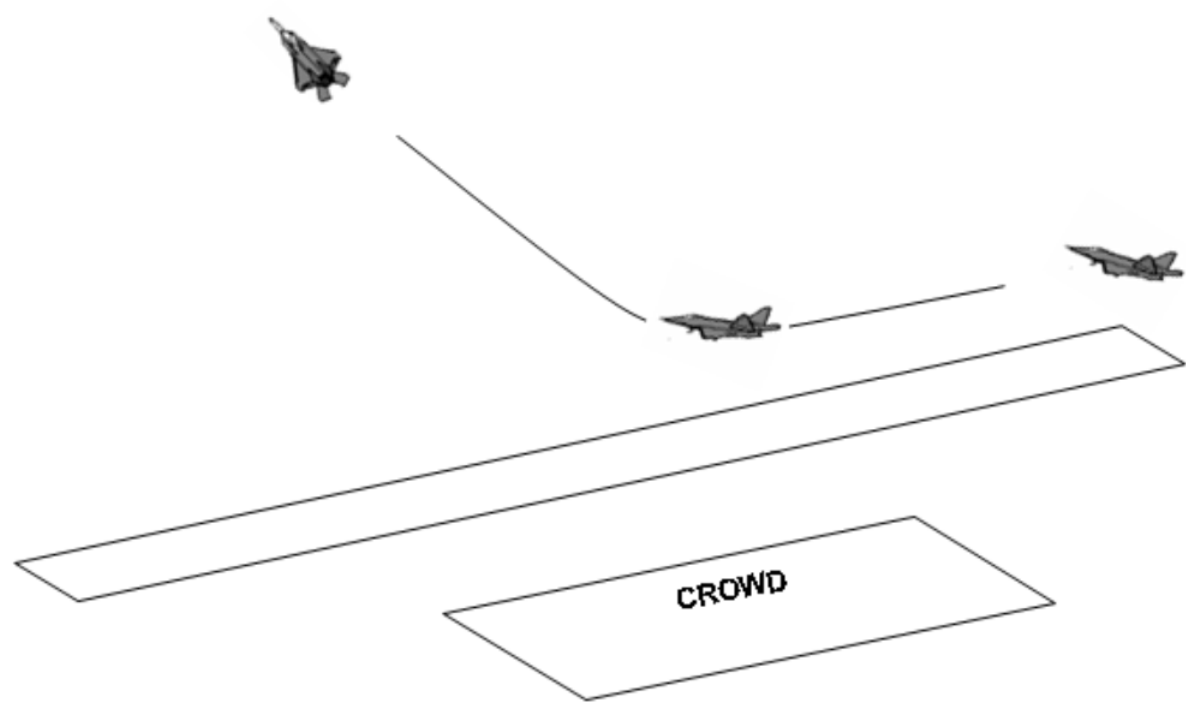
PARAMETER LIMITS				
Altitude AGL	Airspeed KCAS MIN/MAX		Power Setting	G
Entry <b>min</b> 450'	325	375	Thrust for Level Flight ( <i>or A/R</i> )	N/A
Exit <b>min</b> 450'	325	375	Thrust for Level Flight ( <i>or A/R</i> )	N/A

3.14.1. **Maneuver Description:** At 3,000 feet prior to show center with 350 knots and a minimum of 500 feet AGL, raise the nose 5-10 degrees, establish a climb, and relax stick pressure. Apply 3/4 left stick pressure to perform a 360 degree aileron roll. After completing the roll, it is important to ensure the aircraft has gained altitude and the nose is still above the horizon, roll out and perform repositioning maneuver and set up for the Slow Speed Pass.

3.14.2. **Abnormal Procedure:** If starting parameters are not achieved, abort maneuver and transition to a flat pass. If the nose drops below level during the maneuver, immediately roll wings level and climb to minimum altitude.

### 3.15. F-22 Slow Speed Pass/Powerhouse Climb.

Figure 3.6. F-22 Slow Speed Pass/Powerhouse Climb (Right to Left).



F-22 Slow Speed Pass/Powerhouse Climb

Table 3.6. F-22 Slow Speed Pass/Powerhouse Climb Parameters.

TARGET PARAMETERS				
Altitude AGL		Airspeed KCAS		Power Setting
Entry 500'		Maintain 22-26 degrees AOA		MIL
Exit 10,000'		200		MAX

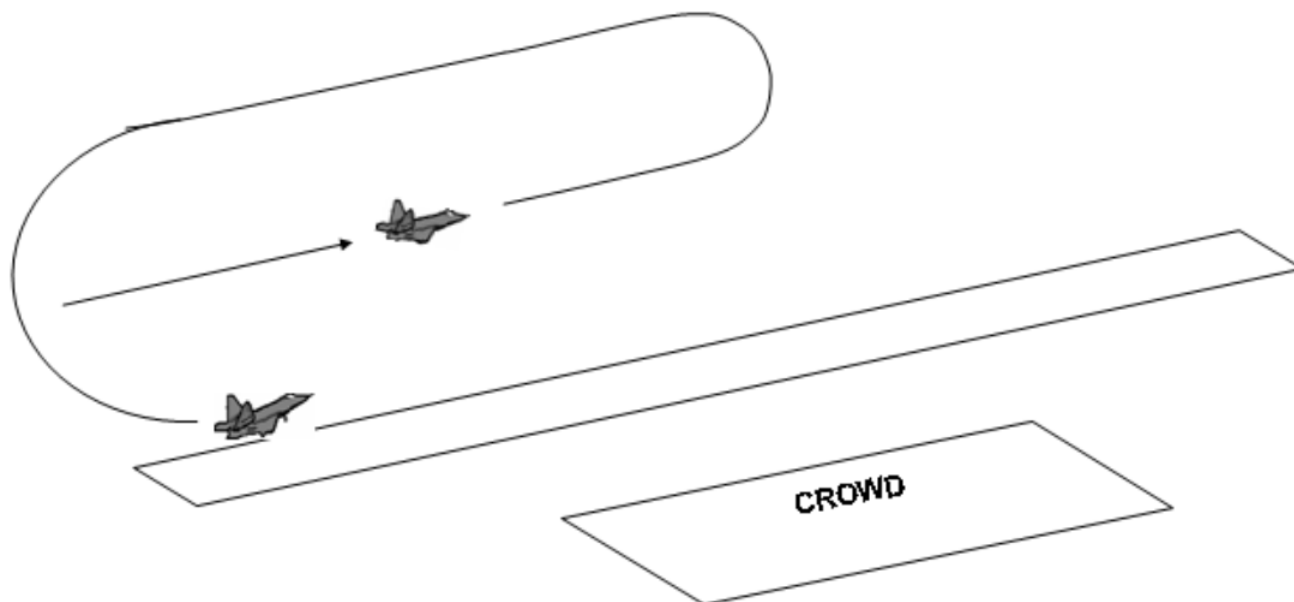
PARAMETER LIMITS				
Altitude AGL		Airspeed KCAS MIN/MAX		Power Setting
Entry min 450'		120	250	MIL
Exit min 5000'		150	250	MAX

3.15.1. **Maneuver Description:** Clean, slow to maintain 22-26 degrees AOA for level flight at 500' AGL in MIL power. After passing show center execute a maximum afterburner climb to 15,000' AGL. Reaching 15,000' AGL start a descent to set up for Overhead Pattern to Full Stop Landing

3.15.2. **Abnormal Procedure:** If entry parameter limits are not met or at anytime during the pass the aircraft descends below 450' AGL, abort the maneuver and perform a wings level pass.

### 3.16. F-22 Overhead to Full Stop Landing

Figure 3.7. F-22 Overhead to Full-Stop Landing.



### F-22 Overhead to Full-Stop Landing

Table 3.7. F-22 Overhead to Full Stop Landing Parameters.

Altitude AGL	Airspeed KCAS	Power Setting	G
Entry 1000'	300	A/R	1-3
Exit Down Wind Alt	Down Wind Speed	A/R	1-3

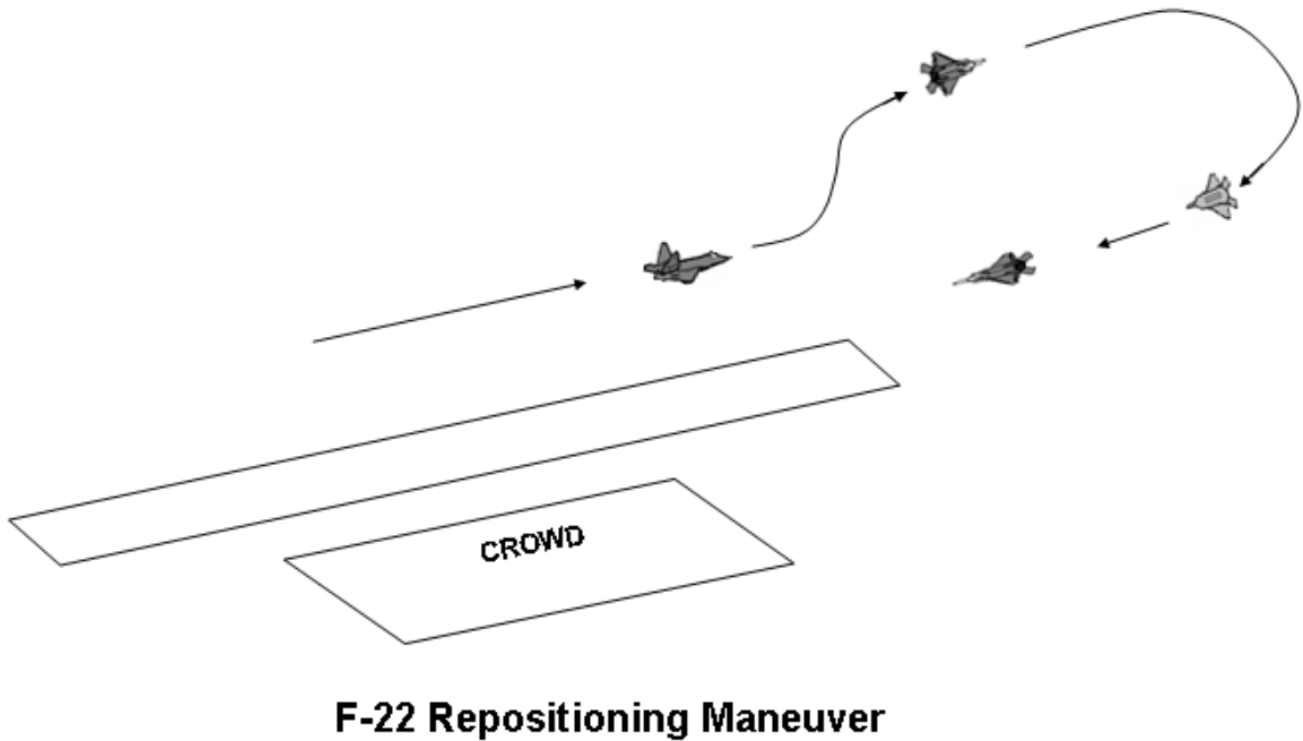
PARAMETER LIMITS				
Altitude AGL	Airspeed KCAS MIN/MAX		Power Setting	G
Entry <b>min</b> 450'	275	325	A/R	1-4
Exit Down Wind Alt	Down Wind -100'	Down Wind +100'	A/R	N/A

3.16.1. **Maneuver Description:** Fly down show line at 500' AGL at show center pitch up into overhead pattern altitude. Configure for and execute a normal final turn and landing.

3.16.2. **Abnormal Procedure:** None.

**3.17. F-22 Repositioning Maneuver.** The Repositioning Maneuver turn is a combination is used to change direction at each end of the show line. The target G for this maneuver is 3Gs. Each turn may differ slightly so that airspeed/altitude parameters for the next maneuver are established in the Repositioning Maneuver. The entry "cut" turn for the Repositioning Maneuver is made to ensure no show line or crowd line penetration.

**Figure 3.8. F-22 Repositioning Maneuver.**



## Chapter 4

### CV-22 DEMONSTRATION MANEUVERS

#### *Section 4A—General Guidelines.*

**4.1. General.** The CV-22 is currently still in early stages of flight test and will not be performing aerial demonstrations.

CHARLES F. WALD, Lt Gen, USAF  
DCS/Air and Space Operations

**Attachment 1****GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION*****References***

DoD Directive 5410.18, *Community Relations*  
DoD Instruction 5410.19, *Armed Forces Community Relations*  
AFI 11-202V3, *General Flight Rules*  
AFI 11-209, *Air Force Participation in Aerial Events*  
AFI 31-101, *Aircraft Systems Security Standards*  
AFI 35-101, *Air Force Public Affair*  
Part 91, Federal Aviation Regulations  
FAA Order 8700.1, Chapter 49

***Abbreviations and Acronyms***

**AGL**—Above Ground Level  
**FAA**—Federal Aviation Administration  
**FLCS**—Flight Control System  
**G**—Gravity  
**HUD**—Heads-Up-Display  
**ICAS**—International Council of Air Shows  
**KCAS**—Knots Calibrated Air Speed  
**KIAS**—Knots Indicated Air Speed  
**MDS**—Mission Design Series  
**MSL**—Mean Sea Level  
**TOLD**—Takeoff and Landing Data  
**VMC**—Visual Meteorological Conditions

***Terms***

**Abnormal Procedure**—Specific abort procedure for maneuver



## Attachment 2

### F-22 DEMONSTRATION NARRATION

**A2.1. F-22 Demonstration Narration.** The narrator will use the following script during the F-22 demonstration.

#### Introduction

Good morning/afternoon ladies and gentlemen, today we'll be seeing a performance by the United States Air Force's air supremacy fighter, which will be operational within the next few years. Taking the active runway is the USAF/Lockheed-Martin F-22 Raptor! This aircraft has the capability of being able to see, identify, and destroy the enemy before ever being detected in any threat environment, at any time. This is called "...first look, first kill". No other fighter in the world has this capability, which makes the Raptor the worlds first and only operational Air Supremacy Fighter. At the controls of the F-22 this morning/afternoon is rank/name from hometown, a veteran fighter pilot with more than number hours in jet aircraft. Launching rank/name is rank/name from hometown and rank/name from hometown.

#### Takeoff

Watch now, as the F-22 goes to full afterburner and begins its take-off roll. The Raptor can take-off in less than 2000 feet. After take-off, the Raptor will rapidly accelerate to 517 miles per hour (450 Knots) and begin a rapid climb to 30,000 feet. The Raptor is powered by 2 revolutionary Pratt and Whitney F-119 turbofan engines. Each engine produces over 17 tons of thrust (35,000 pounds per engine).

#### Supersonic Pass

Once the Raptor and the Eagle/Viper reach 30,000 feet, the Raptor will start a supersonic run in military power. This demonstration is called "supercruise". The F-22 is the only aircraft in the world that can fly at supercruise for sustained periods of time. This capability gives the F-22 the ability to engage the opponent quicker, and extends the Raptor's range because the F-22 will not have to use excessive fuel in afterburner. Look high and to your right as the Raptor begins it's supercruise run.

#### Level Pass

Look to your left, Approaching at a speed of 517 miles per hour (450 knots) is the F-22 Raptor. Rejoining it is the F-15 Eagle/F-16 Viper. (In many ways, we can look at this as a symbolic passing of the torch of fighter air superiority to the F-22 Raptor).

#### Weapon Bay Pass

Ladies and Gentlemen look to your right, as the Raptor and the Eagle/Viper make a formation pass at 345 miles per hour. Take a closer look. You'll notice that the F-22 has opened its weapons bay doors. All weapons are carried internally. The F-15/F-16 carries all of its weapons on external pylons, except for the internal cannon. The Raptor can carry a variety of weapons ranging from the AMRAAM AIM-120, beyond visual range air-to-air missile, to the unequalled AIM-9X "Sidewinder" ultimate dogfight missile. The Raptor also carries the internal M-61A Vulcan cannon. These weapons give the F-22 the stealthy capability that allows it to shoot without being seen by the enemies until it is too late! Today's chase F-15/F-16 is being flown by rank/name from hometown, a veteran fighter pilot with more than number hours in jet aircraft.

### Single Aileron Roll

From your left now...The F-22 will come by at 345 mph and perform a smooth slow roll.

### During Repositioning Maneuver

The Raptor's next pass will demonstrate the fantastic handling capabilities of this air supremacy fighter, and the power that the Pratt and Whitney F-119 engines provide. The Raptor's maneuverability and F-119s allow the F-22 to fly at 60 degrees angle-of-attack at the incredibly slow speed of 92 mph without stalling. Today we'll see the Raptor come by at 26 degrees angle-of-attack at 500 feet.

### Slow Speed Pass/Powerhouse Climb

Watch now as the Raptor approaches from the right... Rank/name powers up the F-119s and makes an afterburner climb out. Rank/name will set up for landing after climbing out to 1,000 feet. The stealth capability, power, and maneuverability (the Raptor can turn at over 9 times the force of gravity), make the Raptor the world's finest....an aircraft that is second to none.

### Overhead Pattern to Full-stop Landing

(rank/name) is now positioning the Raptor for final approach and landing.

### Conclusion

We hope today's demonstration has given you some insight into the capabilities of the F-22 Raptor. We also hope our performance today has sparked an interest in the opportunities you can have as a member of the United States Air Force. (rank/name), our crew chiefs and I will be happy to answer any questions you might have about the F-22, or about your United States Air Force.

On behalf of the MAJCOM commander, (rank/name), I hope you have enjoyed this brief look at the F-22 Raptor.

### **NOTES:**

1. In the event the pilot aborts a maneuver for any reason, the narrator will point out to the crowd that the maneuver has been aborted and that the pilot is setting up for the next maneuver by flying a wings level pass.
2. All information is unclassified. Information was derived from the Flight International Supplement, published by Air International Magazine, 1997.

**Attachment 3****SAMPLE ANNUAL PRESEASON TEAM ASSESSMENT**

**A3.1.** Annual preseason team assessment. Wing commanders will use the following format to submit first year demonstration pilots to Center/CC or NAF/CC and MAJCOM/CC for certification.

**DEPARTMENT OF THE AIR FORCE  
ORGANIZATION  
BASE**

Date

MEMORANDUM FOR: CENTER CC or NAF/CC  
MAJCOM/CC  
IN-TURN

FROM: WG/CC

SUBJECT: Annual Preseason Team Assessment and Certification for (Name of team, e.g. F-22 Aerial Demonstration Team)

1. I have completed the annual preseason team assessment of (name of team) for the (year) air show season and find that the team is fully qualified and prepared to represent the United States Air Force and (insert MAJCOM). Here is a synopsis of the team members and their experience.

PilotExperienceNarratorsExperience

Ground Safety ObserversExperienceMaintainersExperience

2. Please call me at (DSN) if you need further information.

Wing Commander  
Signature Block

cc: MAJCOM/DO  
MAJCOM/DOO

## Attachment 4

## GRADESHEETS

**A4.1. Demonstration maneuver parameters and sample grade sheets.** Demonstration pilots will use an Excel equivalent spreadsheet formatted like the following grade sheet to evaluate their performance. Grade sheets will be provided by AFMC/DOOT. Follow the instructions provided in the file.

**Table A4.1. F-22 – Demonstration Maneuver Grade Sheet.**

Date					<u>Reviewer</u>	<u>Name</u>	<u>Date</u>	
Location					DemoPilot			
RTB					Safety Observer			
Due to MAJCOM					OG/CC			
Profile					WG/CC			
Weather								
Field Elevation								
Maneuver	Target Alt (AGL)	Minimum Alt (AGL)	Actual Alt (AGL)	Target A/S	Parameter A/S	Actual A/S	Remarks	Grade 0-4
Max Performance T/O and Climb Entry	30	20		200	150-.95M			
Max Performance T/O and Climb Exit	15000	15000		450	150->95M			
Supersonic Pass Entry	30000	30000		.95M	.90-.99M			
Supersonic Pass Exit	30000	30000		1.4M	1.3-1.4M			
Flat Pass Entry	500	450		450	425-475			
Flat Pass Exit	500	450		450	425-475			
Weapon Bay Pass Entry	500	450		300	275-325			
Weapon Bay Pass Exit	500	450		300	275-325			
Single Aileron Roll Entry	500	450		350	325-375			
Single Aileron Roll Exit	500	450		350	325-375			
Slow Speed Pass/Powerhouse Climb Entry	A/R 22-26 AOA	450		A/R 22-26 AOA	120-250			
Slow Speed Pass/Powerhouse Climb Exit	5000	4500		200	150-250			
Overhead Break to Full Stop Landing Entry	1000	500		300	275-325			
Overhead Break to Full Stop Landing Exit	Down Wind Alt	Down Wind Alt -100'		300	Down Wind Speed			
								<b>Overall Grade:</b>
ADDITIONAL REMARKS:								

## **Attachment 5**

### **AERIAL SITE SURVEY**

**A5.1. Aerial Site Survey.** Pilots will accomplish following site survey actions in preparation for aerial demonstration.

#### **A5.1.1. Preflight:**

A5.1.1.1. Review airfield diagram (photo if possible) to include runways, taxiways, barriers, show line, crowd line, field elevation, and obstacles (such as towers, mountains, rising terrain, buildings, etc.)

A5.1.1.2. Analyze weather patterns, sun angle/elevation, mountain shadows, for impact on flight profile.

A5.1.1.3. Obtain local no-fly restrictions, noise abatement, and bird procedures.

A5.1.1.4. Review FAA waiver for applicable details, airspace.

A5.1.1.5. Identify control agencies such as on-site tower/local radar (TRACON) traffic control

#### **A5.1.2. Survey Flight:**

A5.1.2.1. Circle show site, fly show line, look for maneuver reference points, and obstacles.

A5.1.2.2. If practical, accomplish aerial survey flight at same time of day as planned aerial demo.

A5.1.2.3. Observe holding points (for F-15 or F-16) and safety chase aircraft)

**Attachment 6****DEMONSTRATION FLIGHT BRIEFING**

**A6.1. Demonstration Flight Briefing.** Pilots will accomplish the following flight briefing actions in preparation for aerial demonstrations:

- A6.1.1. Demonstration pilot will attend FAA mass briefing
- A6.1.2. As a minimum, review the following with ground safety observer:
  - A6.1.2.1. Time hack
  - A6.1.2.2. EP of the Day
  - A6.1.2.3. WX/NOTAMS
  - A6.1.2.4. Mission overview
  - A6.1.2.5. Mission data card
  - A6.1.2.6. Airfield diagram and show layout
  - A6.1.2.7. Review site survey data
  - A6.1.2.8. Accomplish following non-briefing items prior to flight.
- A6.1.3. Ground procedures:
  - A6.1.3.1. Start, taxi, marshalling
  - A6.1.3.2. Spare procedures
- A6.1.4. Takeoff:
  - A6.1.4.1. Runway lineup
  - A6.1.4.2. Minimum fuel
  - A6.1.4.3. Abort procedures
  - A6.1.4.4. Low altitude ejection
  - A6.1.4.5. Land immediately after T/O
- A6.1.5. Aerial Demonstration:
  - A6.1.5.1. Staged vs. local
  - A6.1.5.2. Primary show:
    - A6.1.5.2.1. Maneuvers
    - A6.1.5.2.2. Individual maneuver parameters
    - A6.1.5.2.3. Mandatory parameter radio calls
    - A6.1.5.2.4. WX transition points
  - A6.1.5.3. Abnormals:
    - A6.1.5.3.1. Maneuver abort and reposition

A6.1.5.3.2. Emergencies

A6.1.5.3.3. Ground safety observer termination procedure calls/procedures

A6.1.6. Recovery:

A6.1.6.1. Pattern and Landing

A6.1.6.2. After landing/de-arm

A6.1.6.3. Emergency/alternate airfields

A6.1.7. Debrief

A6.1.7.1. When/where?

A6.1.8. Set aside time to mentally prepare for demo



**Attachment 7****FIRST YEAR DEMONSTRATION PILOT CERTIFICATION CHECKLIST**

**A7.1. First Year Demonstration Pilot Certification Checklist.** The following actions will be taken prior to MAJCOM certification:

\_\_\_\_ 1. NLT Cert – 45 days: WG/CC will pre-certify demonstration pilot and forward grade book to Center or NAF/CC

\_\_\_\_ 2. NLT Cert – 30 days: Center/CC or NAF/CC approve demonstration pilot and forward grade book to MAJCOM/DOO

\_\_\_\_ a. Ensure demonstration pilots have entered training.

\_\_\_\_ b. Inform MAJCOM/DOO of planned Center/CC or NAF/CC and WG/CC certification dates.

\_\_\_\_ 3. MAJCOM/DOO forward SSS to MAJCOM/CC to obtain demonstration team certification

\_\_\_\_ a. Names of pilots that will need certification.

\_\_\_\_ b. General method of certification (individually, two at a time, etc)

\_\_\_\_ c. Dates for certification.

\_\_\_\_ 4. MAJCOM/DOO prepares letter to FAA (AFS 800) to inform them of MAJCOM pilot approved to perform single-ship demonstrations.